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W. B. BIZZELL, President

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DIVISION OF CHEMISTRY

THE CHEMICAL COMPOSITION OF TEXAS HONEY AND PECANS

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COLLEGE STATION, BRAZOS COUNTY, TEXAS

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**In cooperation with the United States Department of Agriculture.

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BULLETIN NO. 272. JANUARY, 1921.

THE CHEMICAL COMPOSITION OF TEXAS HONEY AND PECANS.

BY G. S. FRAPS.

Honey and pecans are two important products of Texas, although the money value is small compared with that of the cotton crop. Yet in both of these products Texas ranks among the most important States in the Union. This is one of the reasons for making a chemical study of these two products in Texas.

The samples secured were obtained from some of the important Texas producers. A description of the samples will be given in the proper place.

METHODS OF ANALYSIS.

The analyses of honey were made on the extracted honey. The analysis of the comb was not made. The pecans were separated into meats and hulls, and the meats were analyzed separately. The methods of the Association of Official Agricultural Chemists were used.

FLAVOR OF HONEY.

Different kinds of honey are produced according to the predominance of the flowers or sugar-producing plants visited by the bees. Some honeys, such as that of buckwheat, have a full bodied, rather acid flavor. Other honeys, such as those from white clover or alfalfa, have a mild, delicate taste. Where orange blossoms abound, the aroma and the flavor of the flowers are well marked in the honey. The honey of one year may be different from that of another, on account of the variation in the abundance of different flowers or plants. The honey produced at one part of the season may be different from that secured later on. On account of the variation in the flavor of honey, some wholesale dealers produce a blend by mixing honey. In this way they endeavor to secure a more or less uniform product.

DESCRIPTION OF SAMPLES.

Pecan samples 9389-9394, inclusive, were kindly furnished by Mr. E. W. Kirkpatrick, McKinney, Texas. The honeys are described as follows:

9194 Honey (mixed honey from horsemint, haw, cotton, etc.), Wilmon Newell, College Station, Texas.
9269 Horsemint honey, A. L. Krueger, New Ulm, Texas.
9270 Huckleberry honey, A. L. Krueger, New Ulm, Texas.
9292 Horsemint honey, Wilmon Newell, College Station, Texas.
9293 Bitterweed honey, Wilmon Newell, College Station, Texas.
9315 Honey (horsemint, catclaw, and mesquite), Faust V. Bush, Floresville, Texas.
9340 Horsemint honey, Wm. Cravens, Route 7, San Antonio, Texas.

9346 Bass wood and horsemint, Z. S. Weaver, Courtney, Texas.
9155 Honey (catclaw, Guajille), E. G. LeStourgeon, Southwestern Bee Co.
9156 Kinninickinic, E. G. LeStourgeon, Southwestern Bee Co.
9157 Horsemint, E. G. LeStourgeon, Southwestern Bee Co.
9158 Cotton, G. W. Griffin, Troy, Texas.
9159 Horsemint and Marigold, G. W. Griffin, Troy, Texas.
9160 Horsemint and marigold, G. W. Griffin, Troy, Texas.
9412 Honey, Rice Williams, Rockdale, Texas.
9488 Cotton Honey, V. P. Robinson, Bartlett, Texas.
9326 Honey, Guajille, J. B. King, Batesville, Texas.
9360 Morning Glory honey, Wilmon Newell, College Station, Texas.

CHEMICAL COMPOSITION OF HONEY.

The chemical composition of various Texas honeys is given in Table 1. The average analyses of some other honeys are included for the purpose of comparison. A thorough study of American honey, by C. A. Browne, is published in Bulletin 110 (1908), Bureau of Chemistry, U. S. Department of Agriculture.

According to these analyses, the composition of Texas honey does not vary, to any large extent, from the average. The water content varies from 16.10 to 20.73. The reducing sugar varies from 71.4 to 79.2. The ash varies from .03 to .61.

Honey is essentially a solution of the sugars, fructose and glucose, with a little cane sugar, in water, containing a small amount of mineral matter and some other substances derived from flowers or plants. It contains only a small amount of protein. It contains some essential oils, and other substances of pronounced odor or flavor from the nectar of flowers, which influence the flavor and aroma of the honey.

Molasses, a by-product of the refining of sugar, contains from 4 to 6.5 per cent. ash and 20 to 33 per cent. water. The remainder consists chiefly of sucrose or cane sugar, and invert sugar, which consists of equal parts of fructose and glucose. The proportion of cane sugar varies with the kind of molasses.

Sorghum syrup contains 30 to 45 per cent. sucrose and 12 to 20 per cent. of fructose and glucose, with about 25 per cent. water. Syrups are prepared by the evaporation and purification of the saccharine juices of plants, with the exception of corn syrup, which is made by heating starch with dilute acid and evaporating after neutralizing the acid. Corn syrup consists of glucose, dextrin, gums and water.

COMPOSITION OF PECANS.

The chemical composition of the pecans studied is given in Table 2, together with the composition of some other foods for purposes of comparison. Attention is called to the difference in the size of the wild pecan and of the cultivated variety. The cultivated pecans are nearly two or three times as large as the wild pecans, and they contain a larger percentage of meats in the nut. They thus contain a higher food value.

The pecan meats are very rich in fat, containing from 69.66 to 74.04 per cent. fat. They contain from 8.69 to 12.21 per cent. of protein. The high percentage of fat gives the pecan a high value as a

Table 1.—Composition of Honey.

	Kind of Honey	Protein, per cent.	Reducing Sugars, per cent.	Sucrose, per cent.	Non-Sugars, per cent.	Water, per cent.	Ash, per cent.	Rotation Direct.
9194	Horsemint, haw, cotton and perhaps others	.44	73.84	1.82	3.89	19.40	0.61	—15.9
9269	Horsemint	.35	76.40	.85	2.52	19.71	.17	—15.3
9270	Huckleberry	.32	71.40	.95	6.95	19.85	.53	—12.4
9292	Horsemint	.37	73.80	1.48	3.40	20.73	.22	—18.4
9293	Bitter-weed	.37	77.50	0.00	2.66	19.17	.30	—16.0
9315	Horsemint, catclaw and mesquite	.55	76.20	0.00	3.39	19.73	.13	—23.7
9340	Horsemint	.49	77.70	.19	3.61	17.84	.17	—25.4
9346	Basswood and horsemint	.28	74.08	.91	4.56	20.01	.16	—17.1
9155	Catclaw and guajille	.31	78.20	1.60	1.84	17.97	.08	—17.0
9156	Kininickinic	.42	74.92	1.22	5.84	17.39	.21	— 5.6
9157	Horsemint	.42	74.48	2.05	6.04	16.91	.10	— 9.8
9158	Cotton	.28	79.24	0.53	3.53	16.10	.32	—12.2
9159	Horsemint and marigold	.35	77.40	0.95	4.77	16.42	.11	— 8.1
9160	Honey	.30	77.08	1.52	3.56	17.25	.29	—14.6
9412	Honey	.51	74.28	2.94	3.02	19.05	.20	—18.0
9488	Cotton honey	.26	72.60	2.39	5.73	18.75	.27	—17.0
9326	Guajille	.24	79.00	.49	2.98	17.26	.03	—18.5
9360	Morning glory	.28	74.72	1.18	4.02	19.59	.21	—19.1
	Average	.36	75.71	1.17	4.02	18.51	0.23	—15.8
	Average of Browne (92 samples)	.....	74.98	1.90	5.24	17.70	0.18	—14.7

human food for the purpose of producing heat or energy. The peanut contains less fat, but more protein, than the pecans.

Analyses of pecan hulls are given in Table 3. They are hard and woody and have no food value.

FOOD VALUES OF HONEY AND PECANS.

The value of a food to the human body depends upon the amount of protein that it will supply, and upon the amount of heat and energy and vitamines that it can furnish. These depend not only upon the chemical constituents of the food, but also upon its digestibility, and upon the value of the digested material to the body. The constituents of different foods do not have the same digestibility, and the digesteed materials do not have the same values to the human body in different foods. There are greater differences with cattle feeds than there are with human foods on this respect.

The protein is represented by lean meat, or the white of eggs, and is used for the purpose of construction, or the repair of the animal body. Greater quantities are therefore needed by the growing animal than by the full-grown animal. The heat or energy is furnished by sugars, starches, fats, and other constituents of the food, which are in a sense burned for producing this heat or energy. Fats are much more concentrated than sugars or starches. Just as a locomotive requires less metal to build, and less to repair, than it does coal to run, so the animal body requires less protein for growth and repair than it requires sugars, starches, and fats, for the purpose of producing heat or energy.

The value of a human food may be expressed in terms of protein, and of calories, the protein representing the tissue-building material and the calories representing the ability to furnish heat and energy. Table 2 shows a comparison between the food value of honey and pecans, and of some other human foods. It is estimated that a man at moderate work requires 0.28 pounds of protein and 3500 calories per day.

The selling price of a food depends not only upon its food value, but upon its flavor, character, the difficulty of securing it, and other factors which are difficult to estimate. Intangible things, such as palatability, and desirability, or apparent desirability, enter into the commercial price. Some of these factors are indeed very important to the human race, but they are quite different from the nutritive value of the food.

Thus honey of good flavor and quality has a value quite superior to that of molasses or syrups. Also, pecans of large size and good shape have a value quite superior to that of the small wild pecans. Both of these values are real values, but are quite distinct from nutrition.

A publication entitled "Honey and Its Uses in the Home," Farmers' Bulletin No. 653, and another entitled "Nuts and Their Uses as Foods," Farmers' Bulletin No. 332, may be of interest to readers of this Bulletin. These Farmers' Bulletins can be secured from the United States Department of Agriculture, Washington, D. C.

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Table 2.—Composition of pecans meat, per cent.

	Description.	Weight Per Nut in grams.	Meats in Nut, per cent.	Protein, per cent.	Fat, per cent.	Crude Fiber, per cent.	Nitrogen-Free Extract, per cent.	Water, per cent.	Ash, per cent.	Calories, per lb.
9389	Stuart	9.51	47.11	10.83	74.08	2.32	8.09	3.04	1.64	.....
9390	Sovereign	7.74	54.52	9.25	72.34	2.63	11.11	3.07	1.60	.....
9391	Halbert	7.36	61.41	8.69	73.65	2.20	10.98	3.03	1.45	.....
9392	Walford	5.69	55.10	11.15	69.66	2.31	11.64	3.62	1.62	.....
9393	San Saba	5.83	60.55	11.10	72.98	2.05	9.21	3.22	1.44	.....
9394	New seedling	8.63	55.60	10.33	75.01	2.00	8.34	2.89	1.43	.....
9395	Native pecans, average size	3.16	49.60	12.21	69.67	3.14	9.57	3.89	1.52	.....
9397	Native pecans, Brazos bottom	3.53	45.33	9.36	71.06	2.64	11.68	3.80	1.46	.....
12640	Commercial pecan meats	.....	.....	11.37	74.08	1.94	8.58	2.49	1.54	.....
12610	Native pecans, Cleburne	.....	48.83	11.85	68.98	2.07	12.23	3.15	1.72	.....
12613	Native pecans, Dallas	.....	43.61	11.12	75.38	2.05	6.63	3.02	1.80	.....
	Average	.....	52.16	10.66	72.44	2.31	9.82	3.20	1.57	3460
	Brazil nut	.....	49.3	17.4	65.0	3.9	5.7	4.7	3.3	3120
	Hickory nut	.....	62.2	15.4	67.4	.....	.....	3.7	2.1	3345
	Pecan, average	.....	50.1	12.1	70.7	3.7	8.5	3.4	1.6	3300
	Peanut, average	.....	27.0	29.8	43.5	2.4	14.7	7.4	2.2	2610
	Peanut, Texas average	.....	25.5	30.9	51.0	2.3	8.6	5.1	2.1	.....
	Round steak	.....	.....	19.5	13.6	.....	.....	65.5	1.1	950
	Cheese, ordinary	.....	.....	27.7	36.1	4.1	.....	27.4	4.0	2145
	Wheat flour	.....	.....	11.4	1.0	0.3	74.8	12.0	0.5	1650
	Cottonseed flour	.....	.....	50.1	10.9	3.9	22.9	6.3	5.8	1823

Table 3.—Percentage composition of pecan hulls.

		Total Phosphoric Acid.	Potash.	Protein.	Fat.	Crude Fiber.	Nitrogen-Free Extract.	Water.	Ash.
13806	From 12604-10-13	.05	.....	2.22	.95	53.57	33.19	8.15	1.92
10451	From 9390	0.04	.36	2.00	.41	57.55	30.05	8.08	1.91
10452	From 9393	0.05	.41	2.19	.34	49.53	36.34	8.59	3.01
10453	From 9395	.....	.....	1.35	.50	57.63	31.05	7.40	2.07
	Average	.05	.39	1.94	.55	54.57	32.66	8.05	2.23